

REMARKS

Applicants request favorable reconsideration and allowance of the subject application in view of the preceding amendments and the following remarks.

Claims 22-32 are presented for consideration in lieu of claims 13-21, which have been canceled without prejudice or disclaimer. Claims 22 and 30-32 are independent. Support for these claims can be found in the original application, as filed. Therefore, no new matter has been added.

Applicants requests favorable reconsideration and withdrawal of the objection and rejections set forth in the above-noted Office Action.

The drawings were objected to on formal grounds. By separate paper, Applicants request approval to amend Figures 1A and 1B. Applicants submit that these changes overcome the Examiner's objections to the drawings. Such favorable indication is requested.

Claims 13, 14, 20 and 21 were rejected under 35 U.S.C. § 112. The Examiner objected to specific recitations in these claims. Claims 13-21 having been canceled, this rejection has become moot and should be withdrawn. Nevertheless, the Examiner's comments were taken into consideration when presenting claims 22-32.

Turning now to the art rejections, claims 13, 14, and 16-19 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 5,907,404 to Marron et al. in view of U.S. Patent No. 5,694,217 to Hizuka. Claim 15 was rejected under 35 U.S.C. § 103 as being unpatentable over the Marron et al. patent in view of the Hizuka patent, and further in view of U.S. Patent No. 5,416,587 to Riccobono et al. Claims 20 and 21 were rejected under 35 U.S.C. §

103 as being unpatentable over the Marron et al. patent in view of the Hizuka patent, and further in view of U.S. Patent No. 5,523,843 to Yamane et al. Applicants submit that the cited art, whether taken individually or in combination, does not teach or suggest many features of the present invention as previously recited in claims 13-21. Therefore, these rejections are respectfully traversed. Nevertheless, Applicants submit that the cited art does not teach many features of the present invention, as recited in independent claims 22 and 30-32, for example, as presented.

In one aspect of the present invention, independent claim 22 recites a position detecting system that includes a light source, a beam splitter for dividing light from the light source into plural light beams, wherein one of the divided light beams produces an intermediate image of an image position in a path of the light before the light is divided, a reflecting member disposed at a position where another of the divided light beams directly produces an image of the image position, an optical system for illuminating a target with light from the intermediate image, wherein the target is disposed at a position which is optically conjugate with the image position, and an image pickup, wherein light from the target and light reflected by a reflecting surface of the reflecting member are re-combined to produce an image interference signal upon the image pickup.

In another aspect of the present invention, independent claim 30 recites a position detecting system that includes a light source, a beam splitter for dividing light from the light source into plural light beams, wherein one of the divided light beams is directed to illuminate a target while another of the light beams is directed to a reflecting member, the target and the

reflecting member both being optically conjugate with a common position in a path of the light before the light is divided, and an image pickup, wherein light from the target and light reflected by the reflecting member are re-combined to produce an image interference signal upon the image pickup. The position detecting system includes a lens in the path of the light beam between the beam splitter and the target, whereas the position detecting system does not include any lens in the path of the light between the beam splitter and the reflecting member.

In a further aspect of the present invention, independent claim 31 recites an exposure apparatus including position detecting means for detecting a position of an alignment mark provided on a surface of a workpiece to be exposed, the position detecting means including (i) a light source, (ii) a beam splitter for dividing light from the light source into plural light beams, wherein one of the divided light beams produces an intermediate image of an image position in a path of the light before the light is divided, (iii) a reflecting member disposed at a position where another of the divided light beams directly produces an image of the image position, (iv) an optical system for illuminating a target with light from the intermediate image, wherein the target is disposed at a position which is optically conjugate with the image position, and (v) an image pickup, wherein light from the target and light reflected by a reflecting surface of the reflecting member are re-combined to produce an image interference signal upon the image pickup, and exposure means for aligning the workpiece by use of positional information related to a position of the alignment mark with respect to a direction along the surface of the workpiece and produced on the basis of the image signal, and for performing a pattern exposure to the workpiece.

In yet another aspect of the present invention, independent claim 32 recites a device manufacturing method that includes a position detecting step for detecting a position of an alignment mark provided on a surface of a workpiece to be exposed, by use of a position detecting system including (i) a light source, (ii) a beam splitter for dividing light from the light source into plural light beams, wherein one of the divided light beams produces an intermediate image of an image position in a path of the light before the light is divided, (iii) a reflecting member disposed at a position where another of the divided light beams directly produces an image of the image position (iv) an optical system for illuminating a target with light from the intermediate image, wherein the target is disposed at a position which is optically conjugate with the image position, and (v) an image pickup, wherein light from the target and light reflected by a reflecting surface of the reflecting member are re-combined to produce an image interference signal upon the image pickup, a pattern exposure step for aligning the workpiece by use of positional information related to a position of the alignment mark with respect to a direction along the surface of the workpiece and produced on the basis of the image signal, and for performing a pattern exposure to the workpiece, and a development step for developing the workpiece having been exposed in the pattern exposure step, whereby a device can be produced from the developed workpiece.

Applicants submit that the cited art, whether taken individually or in combination, does not teach or suggest such features of the present invention, as recited in independent claims 22 and 30-32.

The present invention, as recited in independent claims 22 and 30, for example, is directed to position detecting systems that differ from the cited, such as the Marron et al. patent, at least with respect to the point of the optical conjugate relation between the reflecting member (at 23, for example, shown in Figure 2 of the subject application), and the target (at 1, for example, as shown in Figure 2 of the subject application). In accordance with the arrangement cited in independent claim 22, the reflecting member 23 and the target 1 are placed in an optically conjugate relation with the image position in the path of the light where the light is divided, that is, the position P1 shown in Figure 2. In other words, the target 1 and the image position P1 are optically conjugate with each other, while the reflecting member 23 and the image position P1 are optically conjugate with each other. Specifically, independent claim 22 recites that both of the target 1 and the reflecting member 23 are optically conjugate with a common position (P1) in the path of the light before the light is divided.

Applicants submit that the cited art does not teach or suggest such features of the present invention, as recited in independent claims 22 and 30, for example.

As compared to the present invention recited in independent claims 22 and 30, in the interferometer system of the Marron et al. patent, there is no “common” image position in relation to the reference mirror 42 and the object 36, at the side before the beam splitter 28 (that is, the light source side) and more specifically, in the path of the light before it is divided. In particular, in the Marron et al. patent, the interferometer system is so arranged that parallel light (and not convergent light) is incident on the object 36, such that the light source 12 is never imaged upon the object 36. Applicants submit, therefore, that the Marron et al. patent does not

teach or suggest salient features of Applicants' present invention, as recited in independent claims 22 and 30.

Applicants further submit that the remaining art cited does not cure the deficiencies noted above with respect to the Marron et al. patent.

The Examiner relies on the Hizuka patent for disclosing an interferometer testing system with a pin-hole plate 8 in its first optical system as an optical system that conditions the initial beam from the laser 1 in a desired manner. The Examiner relies on the Riccobono et al. patent for showing the use of a diffuser 12 in conjunction with a beam expander 14 as beam conditioning optics. Still further, the Examiner relies on the Yamane et al. patent for teaching a projection lens system 8 for projecting a pattern of a reticle 9 upon a wafer 11. Applicants submit, however, that these patents, as with the Marron et al. patent do not teach or suggest the salient features of Applicants' present invention, as recited in independent claims 22 and 30, which have been discussed above. Accordingly, those patents add nothing to the teachings of the Marron et al. patent that would render obvious Applicants' present invention, as recited in independent claims 22 and 30.

For reasons similar to those advanced above, Applicants submit that independent claims 31 and 32, patentably define features of the subject invention. In particular, independent claim 31 recites an exposure apparatus and independent claim 32 recites a device manufacturing method. These claims have been patterned after independent claims 22 and 30 and recite, among other features, position detecting means or use of a position detecting system, which include features similar to those discussed above with respect to independent claims 22 and 30.

Accordingly, Applicants submit that the cited art does not teach or suggest such features of the present invention, as recited in these independent claims.

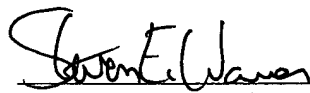
For the foregoing reasons, Applicant submits that the present invention, as recited in independent claim 22 and 30-32, is patentably defined over the cited art.

Dependent claims 23-29 also should be deemed allowable, in their own right, for defining other patentable features of the present invention in addition to those recited in independent claim 22. Further individual consideration of these dependent claims is requested.

Applicant further submits that the instant application is in condition for allowance. Favorable reconsideration, withdrawal of the objection and rejections set forth in the above-noted Office Action and an early Notice of Allowance are requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should be directed to our address listed below.

Respectfully submitted,



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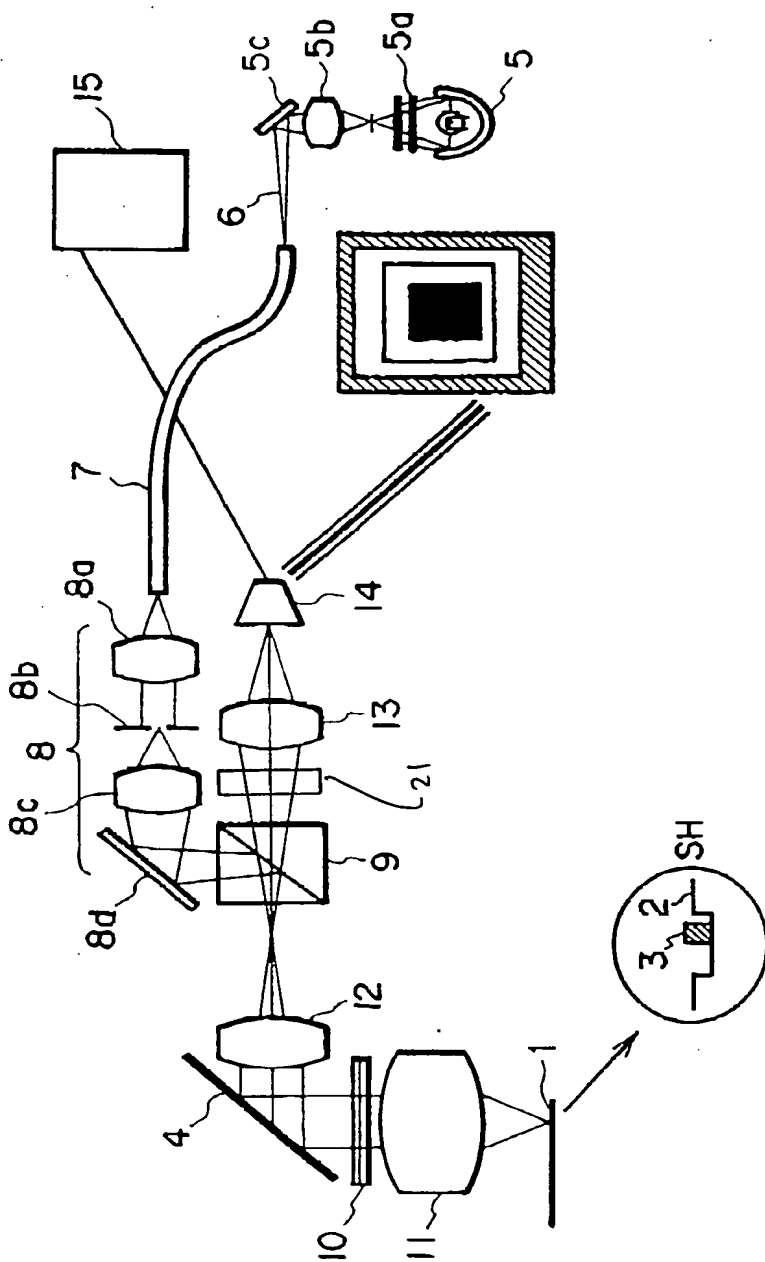


FIG. 1B

PRIOR ART

